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the definitions are well illustrated with simple exercises. Not much is done in the introduction to show the uses of geometry. More exercises in construction would make the introduction more interesting and more effective in fixing new ideas.

The following sentences from the preface suggest the attitude of the authors in the selection and the arrangement of material: "In each Book, the fundamentally important theorems are given first. These theorems present a *safe and sane minimum course.* These are followed in each Book by one or more groups of theorems or applications which are strictly supplementary—material which has either long appeared in geometries in some form or has been introduced in recent years to add to the pupils' interest."

Care has been taken to make the book teachable. Teachers examining this text will be interested in the summaries such as appear on pages 27, 62, and 113; in the references to supplementary exercises in the footnotes; in the treatment of loci and inequalities; and in the suggested proofs which are left for the students to finish. The exercises are numerous and appear to be well graded. There is a table of trigonometric ratios and some problems applying them.

Certain definitions need revision. The definition of a circle given in § 16 is: "A circle is a closed curve all points of which are equidistant from a point within called the center." The circle need not be a plane figure by this definition. The definition of ratio, § 212, reads as follows: "The ratio of two magnitudes of the same kind is the quotient of their numerical measures in terms of a common measure." It seems likely that students will be confused by this definition. The following definition of the limit of a variable is given in § 401: "A limit of a variable is a constant such that the numerical value of the difference between the constant and the variable becomes and remains less than any small positive number." The "small positive number" must of course be pre-assigned.

In three important respects the book has departed little from the traditional. The exercises are mainly formal, with a comparatively small number of applications; not much has been done in applying algebra to the solution of geometric problems; and the notions of motion and symmetry, which are useful and which have become prominent in the teaching of elementary geometry in recent years, have received slight attention.

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Fundamental Conceptions of Modern Mathematics: Variables and Quantities, with a Discussion of the General Conception of the Functional Relation. By ROBERT T. RICHARDSON and EDWARD H. LANDIS. Chicago and London, The Open Court Publishing Co., 1916.

In their preface the authors describe their work as "essentially one of constructive criticism . . . the first attempt made on any extensive scale to examine critically the fundamental conceptions of mathematics as embodied in the current definitions." The present volume, which is to be followed by a second, is concerned with variables and quantities.

No one interested in recent efforts to bring precision and order into the conceptions of mathematics can fail to commend the purpose of the joint authors or to agree with them in their view of the unsatisfactory character of the usual definitions. On the other hand, the book fails, I think, to present any convincing and novel constructive results. The ideas of the authors are not presented either with the clearness or the acumen necessary to make them effective and are not as new as the authors suppose. For example, the main thesis of the authors regarding functional relation, to wit, that it often involves likeness of order of the corresponding quantities of the variables has been expressed with far greater exactness and logical completeness by Russell in his "Principles of Mathematics," Chapter XXXII (On the Correlation of Series); while, on the other hand, the argument (pages 151, 152) by means of which they seek to restrict the notions of variable and function to relations between *ordered* aggregates is not likely to convince "the Peano school" against whom it is directed. Philosophically speaking, a variable denotes *any* term standing in a given relation and a function denotes the relation in question. The definitions of Richardson and Landis simply restrict the broader definitions to more special cases. But the broader definitions should be insisted upon for the sake of the logical unification which they confer upon the various branches of mathematics. And when it comes to the point of giving a constructive definition of variable, the authors resign the effort on the plea that it would require a too lengthy discussion of the philosophical doctrine of the categories (page 154 et seq.).

The consideration of quantity yields an equally disappointing result. Of all the concepts of mathematics requiring clarification, this is the most flagrant; yet, so far as I can see, the present authors only add to the confusion.

More in accord with what the reviewer would regard as sound doctrine is the stand taken against the symbol theory of pure mathematics. For, even before any real objects satisfying the variables in a mathematical expression have been found, the expression is not a mere symbol, but indicates certain operations or relations between *possible* objects. Good remarks are also to be found concerning the distinction between independent and dependent variables (page 175).

Taken as a whole, what the book lacks is exactly what it aims to embody—a philosophical background for the criticism of mathematical ideas. One representative illustration of this is the naïve discussion of similarity and identity on pages 5 and 6. But after all, this is only the first and preliminary volume.

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The Arithmetical Philosophy of Nicomachus of Gerasa. By GEORGE JOHNSON, Ph.D. (University of Pennsylvania dissertation.) New Era Printing Company, Lancaster, Pa. 1916. 49 pages.

This pamphlet presents a partial translation (the complete translation is deposited in the library of the University of Pennsylvania) of the famous *Intro-*